

WHAT IS CLAIMED IS:

1. A method for halftoning image data for a targeted one of plural pixels, comprising the steps of:

testing to determine whether high frequency spatial characteristics are present in the image data at the target pixel;

selecting a halftoning threshold for the target pixel, the halftoning threshold being selected based on whether high frequency spatial characteristics are present at the target pixel, and further being selected in accordance with intensity of the image data at the target pixel in a case where high frequency spatial characteristics are not present;

determining a halftone output value for the target pixel based on a comparison between the selected threshold and the image data for the target pixel; and

diffusing error between the halftone output value and the image data for the target pixel, the error being diffused to pixels adjacent the target pixel.

2. A method according to Claim 1, wherein image data for the target pixel is comprised of original image data plus accumulated error.

3. A method according to Claim 1, wherein in said testing step, the presence of high frequency spatial characteristics is determined based on a gradient between image data for the target pixel and at least one pixel adjacent the target pixel.

4. A method according to Claim 1, wherein in a case where said testing step determines that

10025842.122604

high frequency spatial characteristics are not present, said selecting step selects a halftoning threshold whose spread varies from a fixed threshold in dependence on intensity of the image data.

5

5. A method according to Claim 4, wherein the spread increases at each intensity corresponding to formation of artifacts.

10

6. A method according to Claim 5, wherein the spread increases at each intensity corresponding to an integral fraction of the intensity range.

15

7. A method according to Claim 6, wherein at intervening non-integral fractions of the intensity range, the spread is reduced.

20

8. A method according to Claim 1, wherein in a case where said testing step determines that high frequency spatial characteristics are not present, said selecting step comprises the steps of selecting one of plural threshold masks based on intensity of the image data for the target pixel, and selecting a halftoning threshold from the selected threshold mask.

25

30

9. A method according to Claim 8, wherein each of said plural threshold masks has only a limited number of threshold values, with spread of values in each such threshold mask varying based on its corresponding intensity level.

35

10. A method for halftoning image data for each of plural pixels, comprising the steps of:  
selecting one of plural threshold masks based on intensity of the image data for a target pixel plus an accumulated error;

determining a halftone output value for the target pixel based on a comparison between a threshold in the selected threshold mask and the image data plus accumulated error for the target pixel; and

diffusing error between the halftone output value and the image data plus accumulated error for the target pixel, the error being diffused to pixels adjacent the target pixel;

wherein each thresholding mask has only a limited number of threshold values, with each different one of the plural threshold masks being provided for a different segment of the input intensity range.

11. A method according to Claim 10, wherein a separate threshold mask is provided for each and every input intensity value.

12. A method according to Claim 10, wherein the spread of values in each threshold mask varies based on its corresponding intensity level.

13. A method according to Claim 12, wherein the spread increases at each intensity range corresponding to formation of artifacts.

14. A method according to Claim 13, wherein at intervening non-integral fractions of the intensity range, the spread is reduced.

~~15. A method for halftoning image data for each of plural pixels, comprising the steps of:~~

~~determining whether to apply a selected one of plural threshold masks, or whether to apply a fixed threshold, based on the presence of high~~

10025812-122601

frequency spatial characteristics of the input image;

selecting, in a case that a selected one of plural threshold masks is to be applied, one of said plural threshold masks based on intensity of the image data for a target pixel plus an accumulated error;

determining a halftone output value for the target pixel based on a comparison between a selected threshold and the image data plus accumulated error for the target pixel; and

diffusing error between the halftone output value and the image data plus accumulated error for the target pixel, the error being diffused to pixels adjacent the target pixel.

16. A method according to Claim 15, wherein each thresholding mask has only a limited number of threshold values, with each different one of the plural threshold masks being provided for a different segment of the input intensity range.

17. A method according to Claim 15, wherein each thresholding mask has only a limited number of threshold values, with a separate threshold mask being provided for each different input intensity value.

18. A method according to Claim 15, wherein the spread of values in each threshold mask varies based on its corresponding intensity level.

19. A method according to Claim 15, wherein the spread increases at each intensity range corresponding to formation of artifacts.

10025812.122601

20. A method according to Claim 19,  
wherein at intervening non-integral fractions of the  
intensity range, the spread is reduced.

5 21. A method according to Claim 15,  
wherein the presence of high frequency spatial  
characteristics of the input image is determined  
based on a gradient test by which the spatial  
characteristics at each target pixel are determined  
10 based on whether there is a significant change  
relative to adjacent pixels.

22. A method for halftoning image data for  
each of plural pixels, comprising the steps of:

15 determining a halftone output value for a  
target pixel based on a comparison between a  
threshold and the image data plus accumulated error  
for the target pixel;

20 diffusing error between the halftone output  
value and the image data plus accumulated error for  
the target pixel;

25 wherein error is diffused according to  
error diffusion weights provided for each different  
segment of the range of input intensities including  
a segment at a mid-tone segment.

30 23. A method according to Claim 22,  
wherein weights in the mid-tone segments are  
selected so as to decrease the tendency of the error  
diffusion process to form regular checkerboard  
patterns.

35 24. An apparatus for halftoning image data  
for each of plural pixels, said apparatus comprising  
means for performing the functions specified in any  
of Claims 1 to 23.

10025812-122601

July 82

25. An apparatus for halftoning image data for each of plural pixels, comprising:

a program memory for storing process steps executable to perform a method according to any of Claims 1 to 23; and

a processor for executing the process steps stored in said program memory.

26. Computer-executable process steps stored on a computer readable medium, said computer-executable process steps for halftoning image data for each of plural pixels, said computer-executable process steps comprising process steps executable to perform a method according to any of Claims 1 to 23.

5

10

15

10025812.122601

Sub  
A2